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COMPLETE SPECIFICATION

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Sheet 1

FIG. 1

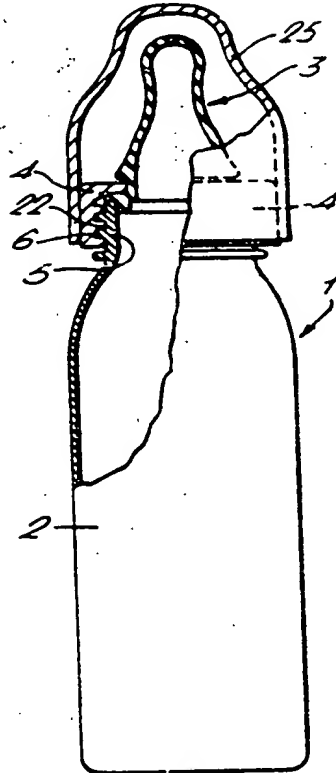
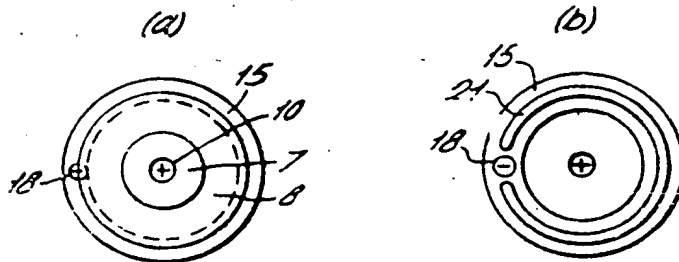


FIG. 3



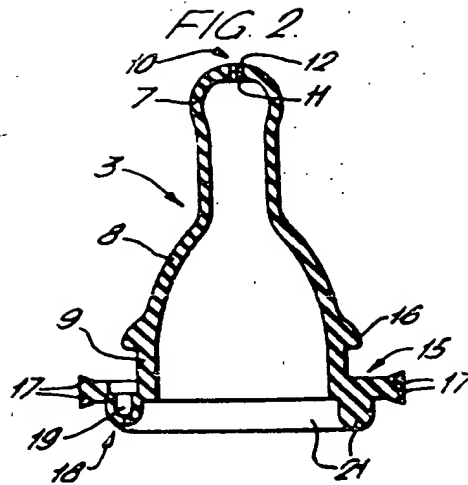
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FIG. 4.

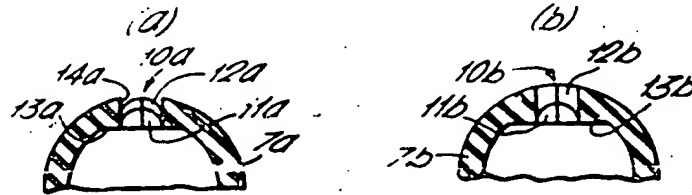


FIG. 5.

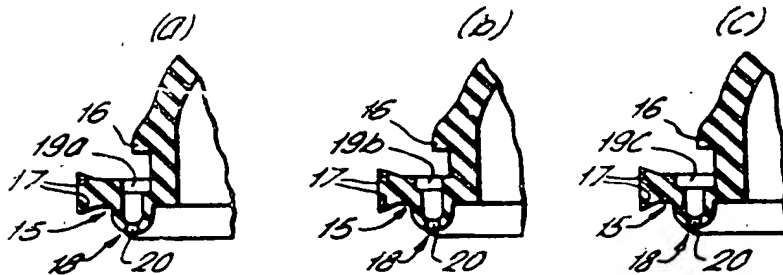
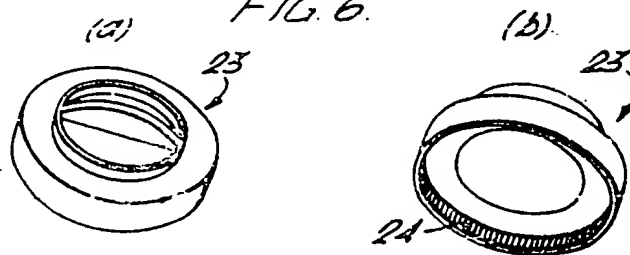


FIG. 6.



# PATENT SPECIFICATION

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## (54) NURSING BOTTLES

(71) I, AKIRA YAMAUCHI, a Japanese Citizen, of No. 121, Tatsumachi, Sasayama-cho, Taki-gun, Hyogo-ken, Japan, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a nursing bottle which can be used generally for infants, and more particularly to a nipple for a nursing bottle which permits automatic regulation of the supply of milk and the inflow of air.

According to conventional nursing bottles there is provided an assembly comprising a bottle for reception of milk or other beverage and a nipple portion attached thereto with a sucking hole formed therein. Conventional nursing bottles have disadvantages both with regard to the selection of the size of the sucking hole thereof and with regard to air inflow thereto. The sucking hole is often made too small or too large. If the sucking hole is too small, it is easily blocked, making it difficult for an infant to suck out the milk in the bottle, or if, contrariwise, the sucking hole is made too large, milk from the bottle is easily spilt, and also the milk flows so freely through the sucking hole that the infant may be choked. The supply of air into the bottle is often insufficient while an infant is being fed, in which case a negative pressure may cause inward collapse of the walls of the feeding end of the bottle, making it difficult to continue feeding. Contrariwise, if the supply of air to the bottle is excessive, too much air may be sucked by an infant under feeding, provided a cause of eructation or choking.

It is an object of the present invention to overcome these disadvantages.

According to the present invention, there is provided a nipple for a nursing bottle, said nipple having a sucking end portion and at least one air valve, the nipple wall being locally thickened adjacent to the extremity of the nipple, a small cavity formed from the inner surface of the central portion of the thickened wall part and a slit membrane

portion provided within the cavity, the said thickened wall part being thicker than the remaining portion of the sucking end portion, the air valve having a cavity of stepped cross section giving an outer portion which is wider than the inner portion.

Preferably, the cavity formed in the thickened wall portion is a small dome-shaped cavity cut from the inner surface of the thick wall portion, the membrane portion of the sucking end portion is a dome- or cone-shaped membrane portion and the slit thereof is disposed so as to intersect the longitudinal axis of the nipple whereby the sucking end portion may act as a non-return valve which prevents a leakage of milk from the nipple to the exterior through the sucking end portion when an infant stops feeding, without preventing a supply of milk through the sucking end portion when the infant is sucking, owing to differences in the sucking end wall thickness.

An X-shaped cross-cut is preferred as the slit in the membrane portion, but the slit may, of course, take other forms, for example, an I-shaped single-cut, or a Y-shaped triple-cut.

Forming the differences of wall thickness in the sucking end portion offers such an advantage that the slit is opened in proportion to the suction force applied only by the pressure exerted by an infant under feeding, thereby making it possible for the milk in the bottle to flow through the sucking end portion in only the direction of the membrane portion from the cavity, and is closed when feeding stops. In other words, the supply of milk from the bottle is automatically adjusted for different infants, and also leakage is prevented. Also, the thick wall portion of the sucking end portion has a function of a waist of a cushion in the sucking end portion, and by means of the thick wall portion, the membrane portion with the slit is reinforced and a growth of the slit is prevented.

The nipple possesses a shape and size suitable for permitting the nipple to be taken into the mouth of an infant, and generally comprises an oval-shaped nipple end, an

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inverted funnel-shaped intermediate portion, and a bottle-mouth cooperating portion. At the lower edge of the bottle-mouth cooperating portion there is provided a contact flange which is of the suitable shape and size for fitting on to the mouth portion of the bottle. The flange is engaged by an inwardly turned rim or a circular large opening at the top of a nipple fastening ring, and is brought into tight contact with the lip of the bottle-mouth when the fastening ring is screwed down. The above-mentioned air valve is provided, either in the inverted funnel-shaped intermediate portion, or at a suitable point in the flange where the flange does not come into direct contact with the bottle-mouth.

Preferably, the air valve is provided in the flange, the inner portion of the cavity of the air valve is cup- funnel-shaped and projects below the flange, the air valve has a cup- or funnel-shaped membrane portion provided just below the inner portion of the stepped cavity, and the membrane portion is formed with a slit which intersects the longitudinal axis of the inner portion of the stepped cavity to provide a passage for air, so that the air valve can serve as a non-return valve which prevents a leakage of milk from the nipple to the exterior through the air valve, without preventing an inflow of air through the air valve when the infant is sucking.

The slit made in the cup- or funnel-shaped membrane portion of the air valve may be an X-shaped cross-cut, a Y-shaped triple-cut, or an I-shaped single-cut.

Forming the stepped cavity and the membrane portion with the slit in the air valve offers such an advantage that the air valve is opened to introduce air therethrough in the direction of the small diameter inner portion from the large diameter outer portion only when the pressure inside the bottle becomes the suction pressure by the infant's suction, and is closed when sucking stops. In other words, the inflow of air into the bottle is automatically adjusted in proportion to the internal pressure of the bottle, and also a counter-current of air and a leakage of milk is prevented.

To protect the air valve there may also be provided a rib which extends higher than the length of the sides of the air valve. If the air valve is provided in the flange, this protective rib is formed on the underside of the flange.

Also, to facilitate engagement of the fastening ring and the bottle-mouth cooperating portion there may be formed an annular projecting ring on the outer surface of the nipple between the intermediate portion and the bottle-mouth cooperating portion.

The nipple is made of a material which is highly transparent, soft, pliant, and hy-

genic, and which can be sterilized in boiling water without loss of characteristics. Examples of such material are commercially available plastics or rubber. The material should also preferably have good heat resistance and wear characteristics. It is advantageous that the material be highly transparent, as this facilitates inspection of the nipple for cleanliness and maintenance of hygiene. The advantage of a soft material is that it may generally be considered that it renders the nipple agreeable to the mouth of an infant and makes sucking easy.

Further according to the invention, there is provided a nursing bottle assembly which comprises a nipple as aforesaid, a bottle which is completely sealed except for the mouth portion of the bottle, and a fastening ring by which the nipple may be detachably attached to the mouth portion of the bottle.

The bottle is generally of extruded plastic fabrication, although it may equally well be made of glass. The bottle is preferably transparent so that milk therein may be seen, and graduations are marked on the side thereof, for convenience of measuring the amount of milk therein.

The shape of the bottle is generally that of a circular cylinder, or that of a polygonal prism approximating a circular cylinder, for example, a hexagonal prism. The bottle may, of course, be other shapes. The bottle forms a completely sealed vessel except for the mouth portion formed at the upper portion thereof. On the outer surface of the bottle around the bottle-mouth there are formed male threads which are for engagement of female threads formed in the inner surface of the nipple fastening ring.

The fastening ring is employed for attachment and detachment of the nipple to and from the bottle, and so is of a suitable size and shape for fitting around the bottle-mouth, is internally threaded for engagement of the external threads of the bottle-mouth and the bottle-mouth cooperating portion, and is suitably made of a material with a certain degree of pliancy, such as plastics.

There is also provided a lid for covering the nursing bottle assembly when the assembly is carried, or not used for a long time. The lid comprises a downward projecting edge whose top to bottom dimension is greater than that of the air valve protection rib. The nipple is placed with its top end inside the bottle, the lid is placed on and over the flange, which is now at the top, and then the assembly is held firmly together by means of the fastening screw. In this configuration, both the sucking end and the air valve are protected.

There is further provided a nipple cover which is large enough to fit over the outside of the nipple, and which may be used to keep the nipple clean when the nursing

bottle is not used for a short time only.

The present invention will hereinafter be described in conjunction with preferred embodiments thereof and with reference to the accompanying drawings, in which:

Fig. 1 is a partly cut-away, front view of a nursing bottle of the present invention.

Fig. 2 is a vertical cross-sectional view of a nipple useable in a nursing bottle of the present invention.

Fig. 3a is a plan view of a nursing bottle nipple.

Fig. 3b is a view showing the underside of a nursing bottle nipple.

Figs. 4a and 4b are vertical cross-sectional views of the sucking end portion of a nursing bottle nipple.

Figs. 5a, 5b and 5c are sectional views showing alternate forms of an air valve for a nursing bottle nipple.

Fig. 6a is a view showing a nursing bottle lid seen from above.

Fig. 6b is a view showing the nursing bottle lid seen from below.

Referring now to Fig. 1, there may be seen the general outline of a nursing bottle assembly 1. The nursing bottle assembly 1 comprises a bottle 2, a nipple 3, and a nipple fastening ring 4.

The bottle 2 is generally cylindrical in shape and is made of transparent plastic. Graduations are marked on the outside surface of the bottle 2, to permit measurement of milk or other beverage contained therein. The bottle 2 forms a completely sealed container except for a bottle mouth 5, which is circular and slightly smaller in diameter than the bottle 2, and formed at the top of the bottle 2. Male threads 6 are formed in the external periphery of the bottle mouth 5.

The nipple 3 is made of a suitable transparent rubber which is soft, pliant and hygienic and may be sterilized in boiling water without altering its characteristics. As shown in Fig. 2, the nipple 3 is an integral portion formed by a generally constricted oval-shaped bulbous nipple end 7, a generally inverted funnel-shape intermediate portion 8, and a bottle-mouth cooperating portion 9.

The inside extremity of the nipple end 7 is formed into a substantially thick wall portion, and in the centre thereof there is formed a sucking end 10. The nipple end 7a and the sucking end 10a formed therein are shown in further detail in Fig. 4a. It will be seen from this drawing that a generally upper-hemispherical, small cavity 11a is formed in the inner surface of the centre top of the nipple end 7a. Above the small cavity 11a there is provided a generally dome- or cone-shaped membrane portion 12a having a cross-cut which intersects the longitudinal axis of the nipple and which forms a non-return outlet structure. The above-mentioned thick wall portion 13a is formed

at the inside extremity of the nipple end 7a, and surrounds the small cavity 11a. The membranous portion 12a is per se curved to form a dome-shape, and also possesses an axially outward margin 14a.

In Fig. 4b there is shown an alternative manner of forming the sucking end 10. It will be seen in this drawing that the formation of the sucking end 10b is similar to that of the sucking end 10a in that the nipple end 7b comprises a small dome-shaped cavity 11b, and a thick wall portion 13b. Also, similarly to the first example illustrated in Fig. 4a, above the small cavity 11b there is provided a generally dome-shaped membrane portion 12b, which is cross-cut, and which constitutes a non-return valve structure. However, the difference between the first and second examples is that, in the second example, the outer surface of the membrane portion 12b is continuously formed with the outer surface of the nipple end 7b. A construction of the sucking end 10b could be fabricated without difficulty.

Referring now to Figs. 2 and 5, the bottle-mouth cooperating portion 9 may be seen to comprise a flange 15. A projecting ring 16 is formed around the outer periphery of the bottom of the inverted funnel-shaped intermediate portion 8. In other words, the projecting ring 16 marks the junction of the intermediate portion 8 and the bottle-mouth cooperating portion 9.

The above-mentioned fastening ring 4, made of a plastic material with a certain degree of flexibility, is internally threaded with female threads 22, with the same pitch as the male threads 6 of the bottle mouth 5. In the top centre of the fastening ring 4, there is formed an inwardly-turned rim or a circular large opening which latches on to the flange 15, and fits between the flange 15 and projecting ring 16. The nipple 3 may therefore be securely attached to the bottle 2, and the bottle 2 may be tightly sealed by screwing the fastening ring 4 over the bottle mouth 5.

Designation at 17 in Figs. 2 and 5, is an annular upstanding flange edge portion, which rests directly on the lip of the bottle mouth 5. The flange edge portion 17 is higher than the adjacent remainder of the flange 15, and serves as means for attaching sealingly the flange 15 to the bottle mouth 5. An air valve 18 is formed at a point in the flange 15, inwards the flange edge portion 17. The air valve 18 comprises a stepped cavity 19 and a cup-shaped membrane portion 20, with upturned edges. The cavity 19 comprises an upper and outer large diameter portion and a lower and inner small diameter portion. The membrane portion 20 is positioned below the inner portion of the cavity 19, and has a single-cut or pair of cuts which intersect(s) the longitudinal

axis of the inner portion of the cavity 19. Further details of examples of the formation of the stepped cavity 19 are shown in Figs. 5a, 5b and 5c. In Fig. 5a there is shown a cavity 19a which possesses a large diameter portion extending radially inwards from the flange 15. In Fig. 5b there is shown a cavity 19b which possesses a large diameter portion extending radially outwards towards the flange 15. In Fig. 5c there is shown a cavity 19c which possesses a large diameter portion extending radially both towards and away from the flange 15.

To protect the membrane portion 20 of the air valve 18, there is formed an annular rib 21 at the bottom of the flange 15. The rib 21 lies inwards the flange outer edge 17 and the top to bottom dimension thereof is greater than that of the upturned edge of the membrane portion 20.

When the nursing bottle assembly 1 is not used for a certain duration of time, it is protected and kept clean by means of a lid 23 which is shown in Figs. 6a and 6b. The lid 23 possesses a size and a form to permit the nipple flange 15 and fastening ring 4 to be fitted around, and embodies a downwardly extending edge 24, whose height is slightly greater than that of the rib 21 at the lower periphery of the nipple 3.

There is further provided a nipple cover 25 for the purpose of keeping the nipple 3 clean when the nursing bottle assembly 1 is unused for a short time only, in which case the nipple cover 25 is fitted over the nipple 3 assembled with the bottle 2 in an upright position. The inside radius of the nipple cover 25 is great enough to permit the nipple cover 25 to fit around the outside of the ring 4, and the height thereof is greater than that of the nipple 3.

To use the nursing bottle of the foregoing construction, first the fastening ring 4 is unscrewed, and the ring 4 together with the nipple 3 are removed from the bottle 2. A suitable quantity of milk is then poured into the bottle 2 through the bottle mouth 5. Next, the nipple 3 is placed on the bottle 2 in an upright position and is firmly attached thereto by screwing down the fastening ring 4 around the bottle mouth 5. When the fastening ring 4 is screwed down, the female threads 22 thereof are engaged by the male threads 6 on the outside of the bottle mouth 5, and the fastening ring 4 pulls the bottle-mouth cooperating portion 9 into firm contact with the lip of the bottle mouth 5.

The nursing bottle assembly 1 thus prepared may now be used to feed an infant. When the nipple 3 is brought to the mouth of the infant the sucking end 10 is first opened slightly by the pressure caused by the infant biting the nipple 3. When the infant begins to suck, the sucking end 10 opens in proportion to the suction force applied. While

the infant is sucking, air is drawn in continuously through the air valve 18. The amount of air supplied through the air valve 18 also depends on the suction force applied by the infant. In other words, the inflow of air into the supply of milk out of the nursing bottle assembly 1 are always automatically matched. When feeding is stopped the sucking end 10 and air valve 18 both close completely.

If feeding is stopped for a short time, the nipple cover 25 is placed over the nipple 3 to keep it clean. If the nursing bottle assembly 1 is not used for a prolonged time, the nipple 3 is placed downwards, with the nipple end 7 inserted in the bottle 2 and covered by the lid 23, and the assembly 1 is held together by means of the fastening ring 4.

As is clear from the above description, the present invention provides a nursing bottle in which the regulation of air is effected accurately and automatically by means of an air valve having a two-stepped cavity structure, and which therefore dispenses with the need for a special tightening element for a fastening ring, as in conventional nursing bottles. In a nursing bottle according to the present invention, the internal pressure of the bottle is always kept constant, and so there are no difficulties for an infant to suck milk owing to differences in sucking end wall thicknesses, and also there is no unnecessary air drawn into cause eructation or choking.

In the nursing bottle of the present invention, the regulation of air depends entirely on the suction force exerted by the infant itself without special means for making adjustments according to the age or strength of an infant. The nursing bottle may therefore be easily used for infants over a wide range of ages.

As soon as an infant stops feeding, both the sucking end portion and the air valve close completely, by which any leakage of milk from the sucking end portion and the air valve is prevented even if the nursing bottle is thrown down or turned upside down. Also, since the nipple is sealingly attachable to the mouth portion of the bottle by means of the tight fitting flange, any leakage of milk from the connection position between the nipple and the mouth portion of the bottle is prevented. A rib on the underside of the flange of the nipple protects the air valve, so that the air valve is kept from deforming or opening in distortion under the weight of the nipple even when the nipple alone is placed in safekeeping for a long time or transported.

The graduations on the nursing bottle make it easy to measure milk, and the fact that the bottle is made of a transparent plastic material that the bottle may be easily

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inspected for cleanliness, and may be dropped without fear of breakage. The invention therefore provides a nursing bottle which is safe and convenient.

#### WHAT I CLAIM IS:—

1. A nipple for a nursing bottle, said nipple having a sucking end portion and at least one air valve, the nipple wall being locally thickened adjacent to the extremity of the nipple, a small cavity formed from the inner surface of the central portion of the thickened wall part and a slit membrane portion provided within the cavity, the said thickened wall part being thicker than the remaining portion of the sucking end portion, the air valve having a cavity of stepped cross section giving an outer portion which is wider than the inner portion.

2. A nipple for a nursing bottle, as defined in Claim 1, wherein the cavity formed in the thickened wall portion is a small dome-shaped cavity cut from the inner surface of the thick wall portion, the membrane portion of the sucking end portion is a dome- or cone-shaped membrane portion and the slit thereof is disposed so as to intersect the longitudinal axis of the nipple whereby the sucking end portion may act as a non-return valve which prevents a leakage of milk from the nipple to the exterior through the sucking end portion when an infant stops feeding, without preventing a supply of milk through the sucking end portion when the infant is sucking, owing to differences in the sucking end wall thickness.

3. A nipple for a nursing bottle, as defined in Claims 1 or 2, wherein the nipple has a contact flange suitably formed for fitting on to the mouth portion of the bottle, the air valve is provided in the flange, the inner portion of the stepped cavity of the air valve is cup- or funnel-shaped

and projects below the flange, the air valve has a cup- or funnel-shaped membrane portion provided just below the inner portion of the stepped cavity, the membrane portion being formed with a slit which intersects the longitudinal axis of the inner portion of the stepped cavity, whereby the air valve may act as a non-return valve which prevents a leakage of milk from the nipple to the exterior through the air valve, without preventing an inflow of air through the air valve when the infant is sucking.

4. A nipple for a nursing bottle, as defined in Claim 2, wherein the slit formed in the dome- or cone-shaped membrane portion of the sucking end portion is an X-shaped cross-cut, a Y-shaped triple-cut or an I-shaped single cut.

5. A nipple for a nursing bottle, as defined in Claim 3, wherein the slit formed in the cup- or funnel-shaped membrane portion of the air valve is an X-shaped cross-cut, a Y-shaped triple-cut or an I-shaped single-cut.

6. A nursing bottle assembly which comprises a nipple in accordance with any one of Claims 1 to 5, a bottle which is completely sealed except for the mouth portion of the bottle, and a fastening ring by which the nipple may be detachably attached to the mouth portion of the bottle.

7. A nipple for a nursing bottle, substantially as hereinbefore described and illustrated by reference to the accompanying drawings.

8. A nursing bottle assembly, substantially as hereinbefore described and illustrated by reference to the accompanying drawings.

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